

**FINAL TECHNICAL REPORT**  
**USGS NEHRP AWARD #03HQGR0133**  
**REMOTE SEISMICITY TRIGGERED BY THE DENALI EARTHQUAKE**

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Research supported by the U.S. Geological Survey (USGS), Department of the Interior under USGS award number 03HQGR0133. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

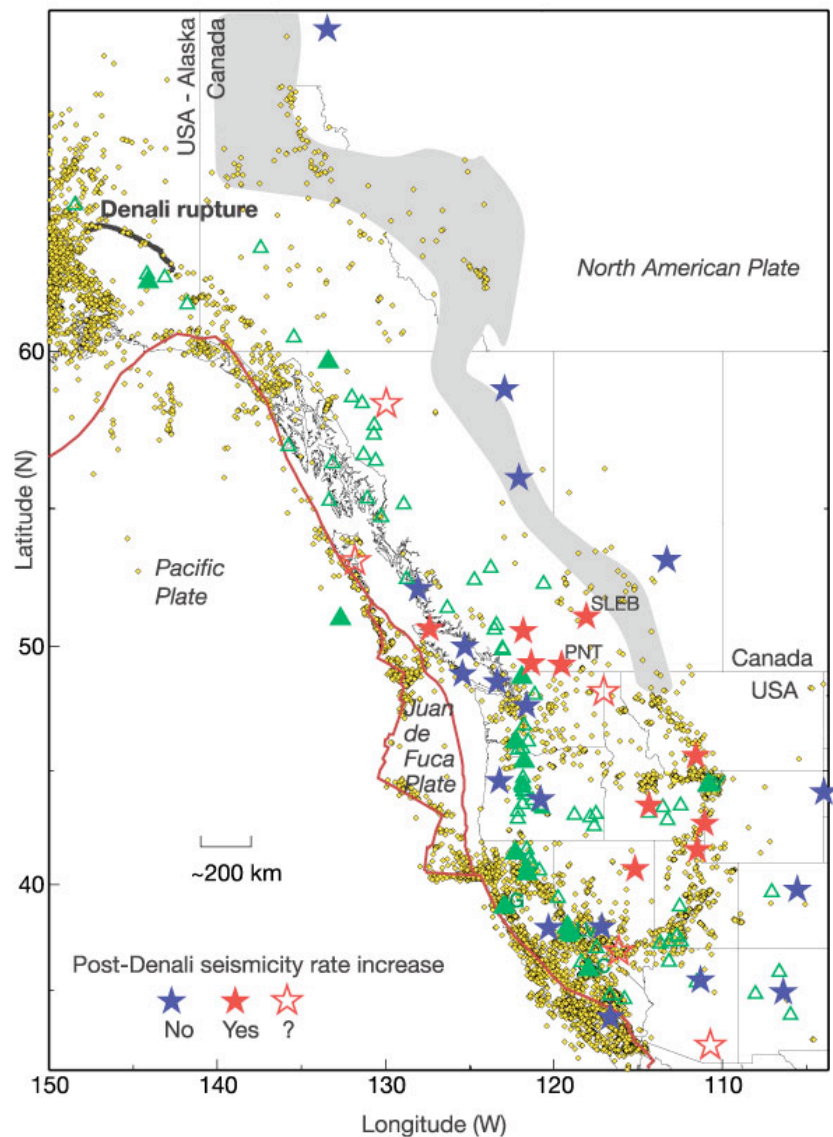
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## **Abstract**

Within seconds to minutes following the arrival of large surface waves from the Mw 7.9 Denali Fault earthquake an unusual number of small earthquakes took place near many seismic stations throughout the western US and Canada to distances exceeding 4000 km. These remotely triggered earthquake sequences persisted with Omori-like time-decaying occurrence rates for hours or days. At first glance, remotely triggered seismicity seems to behave like aftershocks, but instead of being initiated by a local mainshock the sequences are triggered by dynamic deformations of the distant large earthquake. They are difficult to study because many appear to be small, and take place when large scattered signals from the mainshock are still arriving. We study these triggered earthquakes by high-pass filtering broadband seismic recordings from a number of seismic stations in the western Cordillera, and we "calibrate" our single-station observations with data from seismicity catalogs from regional and local networks, where possible. We are seeking to determine whether the remotely triggered earthquakes are restricted to a particular type of tectonic environment and whether their temporal decay reflects "secondary" aftershocks of a rather large triggered earthquake. Or, alternatively do they represent a more "excited" state of faults more generally in the environments where they are observed to take place?

In order to quantify the long-distance triggering effect we examined weeks to months of continuous records from several broadband sites in the lower 48 states and Canada. The records were filtered to highlight local seismic sources, which we identified and counted. We looked for changes in seismicity rate starting at the time of passage of the Denali waves.

Our results suggest that both magmatically active and inactive (though faulted) environments were triggered, and that the triggered sequences are not simply secondary aftershocks. In some regions no triggered earthquakes were observed (as a change in seismicity rate). In other regions triggered earthquakes occurred simultaneously during surface wave passage, but significant rate increases may have ended within minutes to hours. While in other regions anomalously elevated seismicity persisted for at least days. The correspondence between the characteristics of triggered seismicity and presumed magmatic activity and/or tectonic type was poor.



*Shown are the surface trace of the Denali earthquake rupture (black curve), epicenters of pre-Denali earthquakes with magnitudes >2.0 (yellow dots) for a period of five years before the Denali earthquake (3 November 1997–2002), sites of volcanic activity of the Holocene epoch (open green triangles) and historic age (solid green triangles) (see <http://www.volcano.si.edu/world/summinfo.cfm>), and broadband seismograph station sites where seismicity rates were examined before and after the Denali earthquake (stars). Star colours indicate whether the seismicity rate increased at the time of the Denali earthquake. Red lines outline plate boundaries. The Pacific–North American boundaries in Canada southward are transform fault zones, the Juan de Fuca–Pacific boundary ridges and transform faults. The Juan de Fuca plate subducts beneath North America, resulting in volcanic chains. The grey band in Canada outlines the 'morphogeologic' transition between deformed strata on the west and flat-lying undeformed strata to the east, or the boundary with stable North America. Geothermal areas where the Denali earthquake triggered seismicity rate increases that are documented elsewhere are not shown.*

### Contact Information and Data Availability

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### Educational Impact of Project

Funding from this award was used to partially support the thesis work of one Masters student, Tandrima Mukherjee. In addition, the award provided support and educational experiences for an undergraduate student.

**Bibliography of Publications Resulting from Project**

Mukherjee, T.; Bodin, P.; Gomberg, J. (2005), Characteristics of Seismicity Triggered Remotely by the Mw7.9 Denali Fault Earthquake, Eos Trans. AGU, 86(18), Jt. Assem. Suppl., Abstract S41D-04